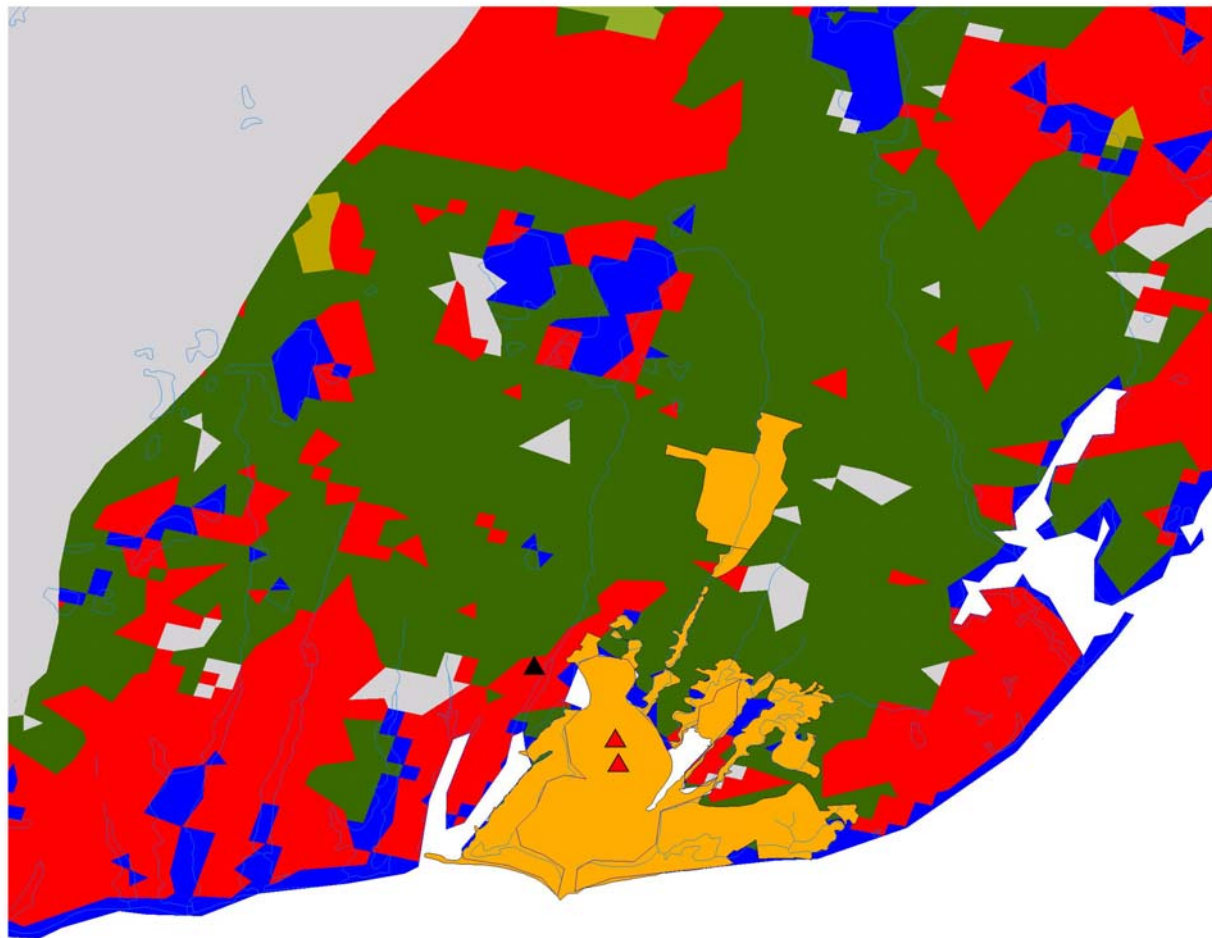


Waquoit Bay



- YSI Sites
- ▲ Within NERR
 - ▲ Not Within NERR
- Rivers
- NERR Management Zone
- Core
- Land Use Group
- Agricultural Land
 - Barren Land
 - Forest Land
 - Rangeland
 - Urban or Built-up Land
 - Water
 - Wetland

Waquoit Bay, Central Basin (WQBCB)

Characterization (Latitude = 41° 33'56" N; Longitude = 70° 31'16" W)

Tides in Waquoit Bay are semidiurnal with an average range of about 0.4 m. Largely because of the shallow conditions, restricted tidal inlet, and low amplitude tidal signal, tides in the bay are also strongly influenced by wind forcing. The Bay, itself, is about 3 km long, 1.5 km wide, and has a surface area of about 380 ha. Average depth in the bay is 1.3 m (MHW). The site is rather typical of southern New England shallow coastal bays. At the sampling site, the depth is about 2 m (MHW) and monitoring probes are positioned about 0.75 m above the bottom. Bottom sediments are organic rich silts and medium sands. Thick (up to 0.3 m) macroalgae (seaweed) mats overlie much of the bottom of the bay, and largely consist of species *Cladophora vagabunda*, *Gracilaria tikvahiae*, and *Enteromorpha* sp. The dominant marsh vegetation near the sampling site are *Spartina alterniflora* and *Spartina patens*. Dominant upland vegetation includes mixed forests of red oak, white oak, and pitch pine, and other shrubs and plants common to coastal New England. Land-use in the bay's watershed is about 60% natural vegetation, but the remaining land is largely residential, with some commercial (retail malls), and minor amounts of agriculture (~3%, cranberry bogs). Activities most likely to impact the site include enhanced nitrogen loads derived from individual residential septic systems and intensive recreational boating during the summer months.

Descriptive statistics

Twenty-five deployments were made at this site between May-Jul 1996, May-Dec 1997, and Aug-Dec 1998 (Figure 73). Mean deployment duration was 13.6 days. Seven deployments (Jun-Aug 1997, Nov 1997, and Aug 1998) were less than 10 days.

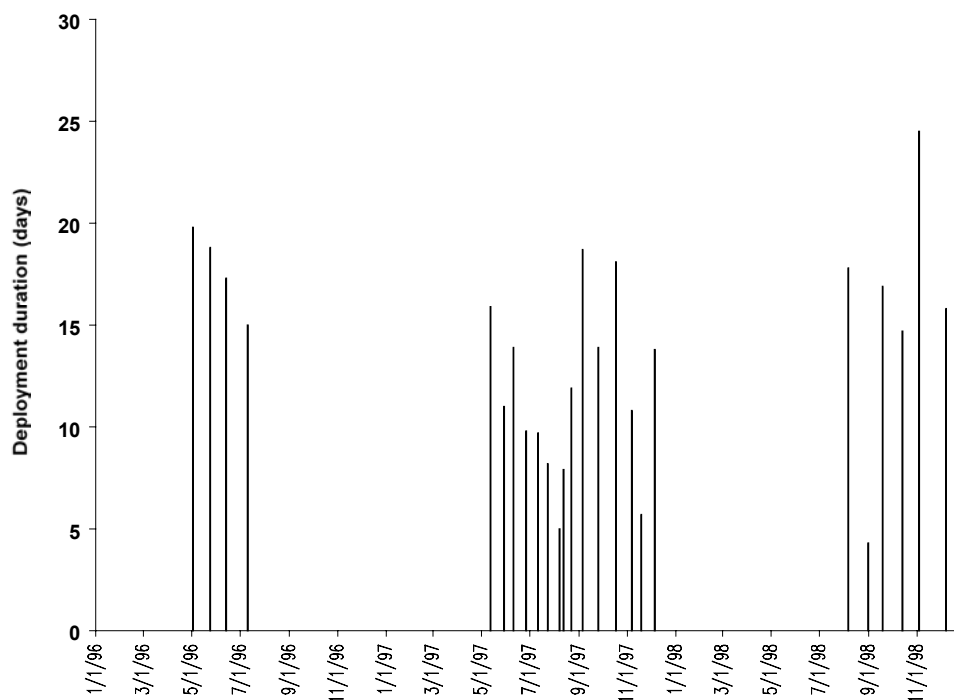


Figure 73. Waquoit Bay, Central Basin deployments (1996-1998).

Thirty-one percent of annual depth data were included in analyses (19% in 1996, 48% in 1997, and

26% in 1998). Sensors were deployed at a mean depth of 1.4 m below the water surface and 0.8 m above the bottom sediment. Scatter plots suggest moderate fluctuations (0.5-1.0 m) in depth throughout the data set. Harmonic regression analysis attributed 61% of depth variance to 12.42 hour cycles, 10% of depth variance to 24 hour cycles, and 29% of depth variance to interaction between 12.42 hour and 24 hour cycles.

Thirty-one percent of annual water temperature data were included in analyses (19% in 1996, 48% in 1997, and 26% in 1998). Water temperature followed a seasonal cycle; however true annual minimum temperatures are unknown because water temperature data were not collected in winter (Figure 74). Mean water temperatures were 15-20°C in spring, 20-25°C in summer and 5-10°C in fall. Minimum and maximum water temperature between 1996-1998 was 0.9°C (Dec 1997) and 27.5°C (Jul 1997, Aug 1998), respectively. Scatter plots suggest moderate fluctuations (1-4°C) in daily water temperature and strong fluctuations (3-7°C) in bi-weekly water temperature throughout the data set, particularly in summer. Harmonic regression analysis attributed 68% of temperature variance to 24 hour cycles, 31% of temperature variance to interaction between 12.42 hour and 24 hour cycles, and 1% of temperature variance to 12.42 hour cycles.

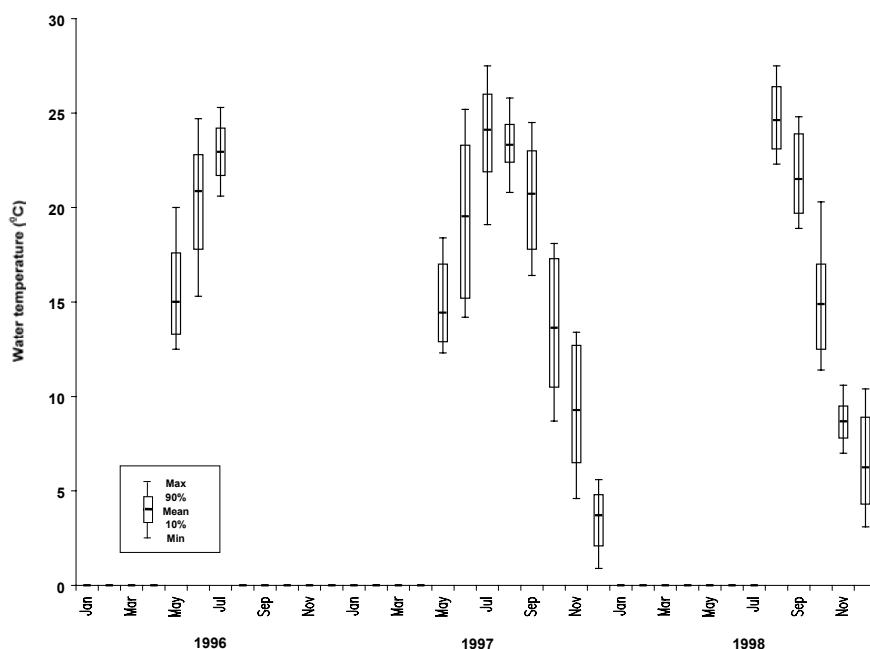


Figure 74. Water temperature statistics at Central Basin, 1996-1998.

Thirty-one percent of annual salinity data were included in analyses (19% in 1996, 48% in 1997, and 26% in 1998). Mean salinity was 28-32 ppt throughout the data set, with no discernable seasonal cycle (Figure 75). Minimum and maximum salinity was 21.8 ppt (May 1996) and 32.6 (Dec 1997), respectively. Scatter plots suggest daily and bi-weekly fluctuations in salinity equivalent to or in excess of annual variation in mean salinity (4 ppt). Harmonic regression analysis attributed 59% of salinity variance to interaction between 12.42 hour and 24 hour cycles, 26% of salinity variance to 24 hour cycles, and 15% of salinity variance to 12.42 hour cycles.

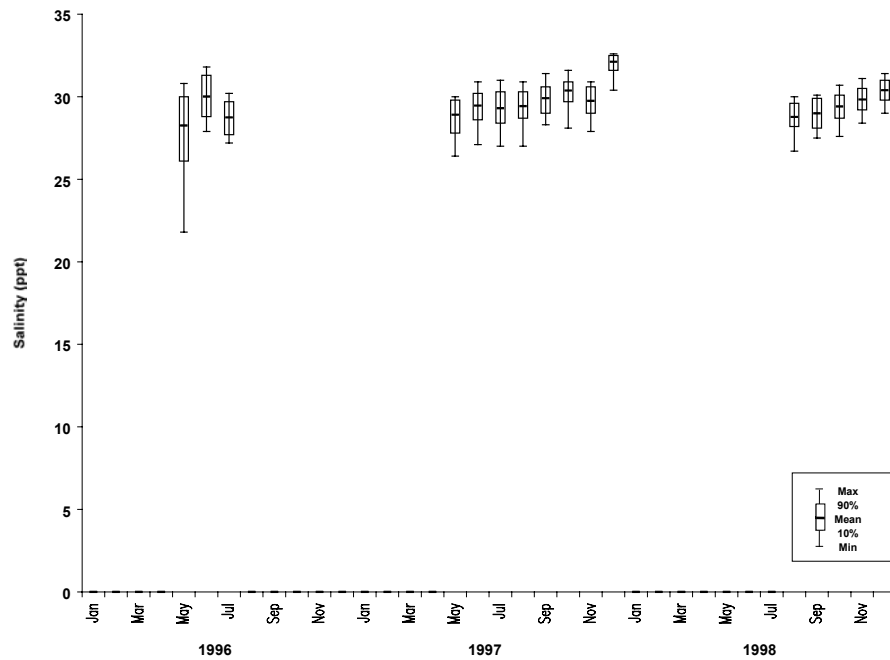


Figure 75. Salinity statistics for Central Basin, 1996-1998.

Twenty-nine percent of annual dissolved oxygen (% saturation) data were included in analyses (15% in 1996, 47% in 1997, and 24% in 1998). Mean DO was 92-140% saturation throughout the data set. Minimum and maximum DO was 4.3% saturation (Jun 1996) and 269.6% saturation (Jun 1997), respectively. Hypoxia was observed in one month (Jun 1996) and persisted for 1% of the first 48 hours post-deployment (Figure 76). Supersaturation was observed during every month of data collection, except for Dec 1997, and persisted for 29.7% of the first 48 hours post-deployment on average. Scatter plots suggest strong fluctuation (80-200%) in percent saturation throughout the data set, with greatest fluctuation occurring in summer. Harmonic regression analysis attributed 43% of DO variance to 12.42 hour cycles, 50% DO variance to interaction between 12.42 hour and 24 hour cycles, and 7% of DO variance to 24 hour cycles.

Photosynthesis/Respiration

Almost all (92%) of the data used to calculate the metabolic rates fit the basic assumption of the method (heterogeneity of water masses moving past the sensor) and was used to estimate net production, gross production, total respiration and net ecosystem metabolism (Table 21). Instrument drift was not a problem at this site. Gross production slightly exceeded total respiration at Central Basin, and the net ecosystem metabolism and P/R ratio indicated that this site is slightly autotrophic, one of two sites in the Reserve system that was autotrophic (Figure 77). Temperature was significantly ($p < 0.05$) correlated with gross production and total respiration. Gross production and respiration increased as temperature increased. Salinity was not significantly ($p < 0.05$) correlated with any metabolic measurement.

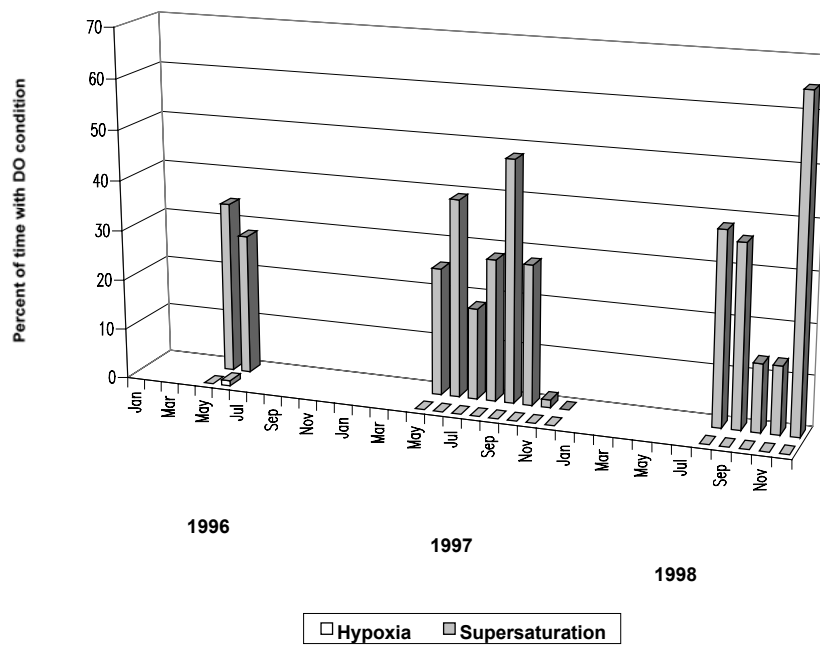


Figure 76. Dissolved oxygen extremes at Central Basin, 1996-1998.

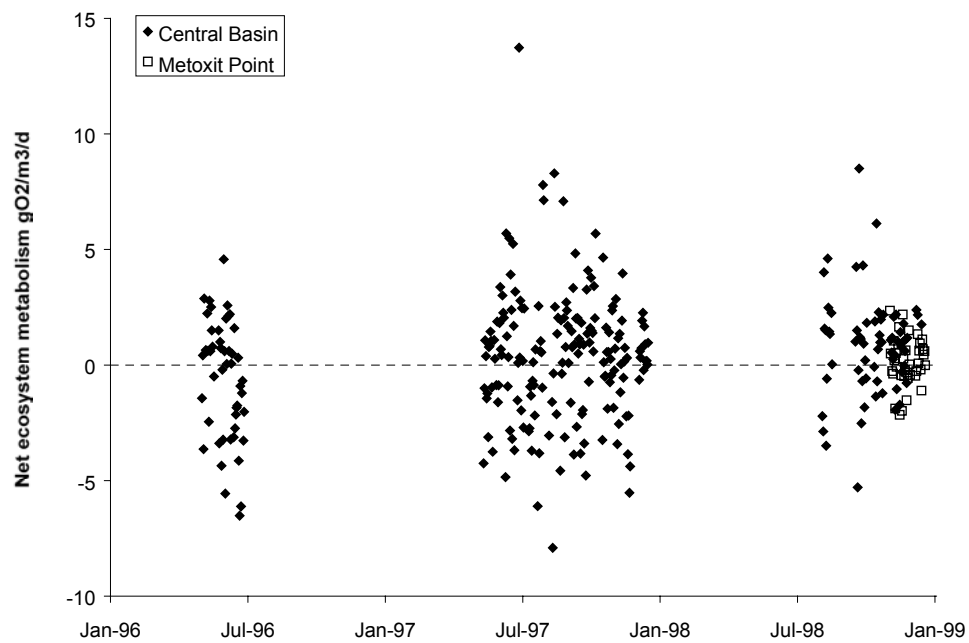


Figure 77. Net metabolism at Central Basin, 1996-1998.

Table 21. Summary of metabolism data and statistics at Central Basin, 1996-1998.

Central Basin	mean	s.e.
Water depth (m)	1.14	
Net production gO ₂ /m ³ /d	3.39	0.16
Gross production gO ₂ /m ³ /d	7.54	0.32
Total respiration gO ₂ /m ³ /d	7.29	0.33
Net ecosystem metabolism g O ₂ /m ³ /d	0.26	0.15
Net ecosystem metabolism g C/m ² /y	334	
P/R	1.04	
Statistical results		
Drift – paired t-test		
Gross production	ns	
Total respiration	ns	
Net ecosystem metabolism	ns	
Percent useable observations	92 %	
Paired t-test on gross production and total respiration	p = 0.05	
Correlation coefficient	Temperature	Salinity
Gross production	0.47	ns
Total respiration	0.46	ns
Net ecosystem metabolism	ns	ns

Waquoit Bay, Metoxit Point (WQBMP)

Characterization (Latitude = 41° 34'08" N; Longitude = 70° 31'18" W)

The Metoxit Point site is only a few hundred meters from the Central Basin site and became the replacement site for Central Basin in 1998. For this reason, its general characteristics are essentially identical to those outlined for the Central Basin site; however, there are some minor but important differences with respect to the amount of hydrographic variability at this site.

Descriptive Statistics

Two deployments were made at this site in Nov 1998 (28.6 day) and Dec 1998 (15.8 days).

Sensors were deployed at a mean depth of 1.1 m below the water surface and 0.8 m above the bottom sediment. Scatter plots suggest moderate fluctuations (0.5-0.8 m) in depth in Nov and Dec 1998. Harmonic regression analysis attributed 63% of depth variance to 12.42 hour cycles, 22% of variance to interaction between 12.42 hour and 24 hour cycles, and 15% of variance to 24 hour cycles.

Mean water temperature in Nov and Dec 1998 was 8.6°C and 6.4°C, respectively. Minimum and maximum temperature was 3°C and 10.6°C, respectively. Scatter plots suggest moderate fluctuation ($\leq 3^\circ\text{C}$) in daily water temperature and strong fluctuations (2-6°C) in bi-weekly water temperature, with greater fluctuation in Dec than in Nov. Harmonic regression analysis attributed 70% of temperature variance to 24 hour cycles, 25% of temperature variance to interaction between 12.42 hour and 24 hour cycles, and 5% of temperature variance to 12.42 hour cycles.

Mean salinity in Nov-Dec 1998 was 29.6-29.9 ppt. Minimum and maximum salinity was 27.4 ppt and 31.1 ppt, respectively. Scatter plots suggest moderate (< 5 ppt) fluctuations in daily and bi-weekly salinity in Nov and Dec, with slightly greater fluctuation in Nov. Harmonic regression analysis attributed 65% of salinity variance to interaction between 12.42 hour and 24 hour cycles, 26% of salinity variance to 24 hour cycles, and 9% of salinity variance to 12.42 hour cycles.

Mean dissolved oxygen (% saturation) in Nov-Dec 1998 was 100-102% saturation. Minimum and maximum DO was 70.5% saturation and 125.6% saturation, respectively. Hypoxia was never observed. Supersaturation was observed in Nov and persisted for 2% of the first 48 hours post-deployment. Scatter plots suggest moderate fluctuation ($< 50\%$) in percent saturation at daily and bi-weekly intervals, with slightly greater fluctuation in Nov than in Dec. Harmonic regression analysis attributed 63% of DO variance to 24 hour cycles, 32% of DO variance to interaction between 12.42 hour and 24 hour cycles, and 5% of DO variance to 12.42 hour cycles.

Average metabolic rates and other statistics were not calculated for Metoxit Point because only 47 days of data were available, between November 3, 1998 and December 23, 1998. Rates at this site were very similar to those measured in the Central Basin.